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Formal models of statutory interpretation in multilingual legal systems

Burkhard Schafer

Abstract: Using the case of *Buchanan v. Babco*, the paper argues that multi-lingual settings are particularly apt for disclosing underlying cognitive and reasoning tasks that lawyers have to perform when interpreting a statute. It shows how approaches developed in computer science to model the way in which conflicting ontologies or worldviews are merged and inconsistencies between them repaired.

1. Introduction: multilingual statutory interpretation as a challenge for legal AI

Computational legal theory aims to test our jurisprudential intuitions, theories and hypothesis by replicating, to the degree that this is possible, legal reasoning by human experts with inferences carried out by explicitly specified, formal software systems. As a field of research within the broader field of Artificial Intelligence and Law, it can be distinguished from applied legal AI – building software tools that assist legal practitioners and decision makers — and those strands in artificial intelligence research that merely use examples from law and legal reasoning to illustrate the advantages and disadvantages, potentials and limitations of more generic models of human intelligence. In the latter approach, our aim is to increase our understanding of human intelligence as a domain-independent, multi-purpose capability, and insights about legal reasoning are only incidental to this task. In the former, we aim to improve legal practice, but not necessarily

by faithfully replicating the thought processes of human lawyers. Rather, identifying weaknesses in current practice and replacing them with tools that deliver better results – an outcome-driven approach – is the main motivation. While both approaches may also increase our understanding of traditional forms of legal reasoning, this is more an incidental result of the attempt to ultimately transcend it. Interpreting statutes is obviously a highly relevant skill that a lawyer must acquire, and therefore also task a legal AI should aim to replicate.

Early legal expert systems and legal AIs frequently were rule-based systems that translated statutory provisions more or less directly into a logical programming language such as PROLOG.¹ Despite their simplicity, for the right type of application they did result in useful tools; for instance, administrative “back office” applications that automate certain forms of low-level legal decision making, such as completeness and consistency checking of tax returns filed online; calculating the right level of social security benefits owed under social security law;² or helping with complex but repetitive compliance tasks.³ In these applications, we typically have clear and often very technical legal rules with unambiguous antecedents (“do you earn more than £30,000 annually” or “does your company employ more than 50 workers”), and in a significant number of the cases it will encounter, the

¹ For a historical overview, see Bench-Capon et al. "A history of AI and Law in 50 papers: 25 years of the international conference on AI and Law" *Artificial Intelligence and Law* 20, no. 3 (2012): 215-319. For an example of an early rule-based system that modelled a part of UK statute law, see For a specific example that models statutory provisions in an early AI, see e.g. Sergot, Cory, Hammond, Kowalski, Kriwaczek, and Sadri "Formalisation of the British Nationality Act" *International Review of Law, Computers & Technology* 2, no. 1 (1986): 40-52.

² For an early discussion see e.g. Bench-Capon, Robinson, Routen, and Sergot "Logic programming for large scale applications in law: A formalisation of supplementary benefit legislation." In *Proceedings of the 1st International Conference on Artificial Intelligence and Law*, pp. 190-198, ACM, 1987.

³ See e.g. Breaux, Vail, and Anton "Towards regulatory compliance: Extracting rights and obligations to align requirements with regulations." In *Requirements Engineering, 14th IEEE International Conference*, pp. 49-58, IEEE, 2006.

application to the fact situation is unproblematic and only involves the core meaning of the operative legal terms. The added value of implementing them as a computer expert system lies in the speed with which these systems can operate and the fact that they do not get bored or distracted by repetitive tasks. However, the amount of legal intelligence that they represent is minuscule, and they typically deal with tasks that have previously been dealt with by paralegals or similar support and administrative staff. Most of the “heavy lifting”, from a legal reasoning perspective, is done during the development stage when programmers (together with legal experts) extract appropriate rules from the statute(s) of interest, turn them into machine-readable format and in doing so also fix their meaning.⁴ This translation process from natural language statutory text to machine-readable formalism often hides crucial interpretative choices that are made by the knowledge engineer. The software user thus encounters the law already in its sanitised, disambiguated form. While this delivers useful results for selected applications, many more demanding legal tasks require an explicit reasoning about the meaning of legal norms.

One approach sometimes found in argumentation support systems is simply to add rules of statutory interpretation to the rule base of the system. For example, rules of the form ‘If two laws contradict each other, then chose the one that was enacted later to decide the case’ could serve as an approximation of the *lex posterior derogat legi priori* rule of statutory interpretation. However, in this translation process too something important gets lost. From the perspective of the computer programme, this rule is not categorically different from any other primary legal rule, e.g. the rule that ‘if a single bank transaction is

⁴ For an early discussion see Poulin, Bratley, Frémont, and Mackaay "Legal interpretation in expert systems." In *Proceedings of the 4th International Conference on Artificial Intelligence and Law*, pp. 90-99, ACM, 1993.

worth more than £10,000 then carry out a money laundering risk assessment'. The 'aboutness' of canons of interpretation, their nature as meta-rules that talk about the other rules in a system, gets lost; and "legal norms" become just one other object in the universe of discourse of the formal system: not different from (say) houses, knives or contracts. With that, many of the cognitive tasks that a lawyer has to perform to interpret a statute are again pushed outside the system and remain a responsibility of the user. In the mini-example above, the user — rather than the legal AI — has to make the determination that there is indeed a conflict between the two rules *as interpreted*.

A more promising approach soon emerged which combined rule-based systems with case-based reasoners. This reflects a common legal practice: if in doubt what a legal term means, going back to a 'Cases and Materials' textbook — or consulting a commentary that links the statutory provision to the cases decided under it — is, of course, an important problem-solving strategy. However, the dominance of this approach in the field of legal AI cannot be explained only by it matching actual legal practice. It owes a great deal to the success that case-based reasoning, including machine learning, had in general artificial intelligence research.⁵ In hybrid rule-based and case-based legal expert systems then, ambiguous statutory terms are resolved with reference to 'past experience'; that is, the relevant case law (and one might speculate whether the predominance of this approach also reflects the predominance of common law based researchers in the legal AI field).⁶ In this approach too some of the crucial cognitive tasks that a lawyer performs are lost. The expert system might correctly deduce that the legal rule 'If X is a vehicle, then X must not enter

⁵ For an up-to date overview see Kolodner, J. *Case-based Reasoning*, Morgan Kaufmann, 2014.

⁶ See e.g. the highly influential Rissland and Skalak "CABARET: rule interpretation in a hybrid architecture" *International Journal of Man-Machine Studies* 34, no. 6 (1991): 839-887.

the park' is not triggered when, in the case in question, the 'vehicle' is a children's toy: because in all precedent cases in the knowledge-base of the system, the rule was only triggered in cases where the vehicle was of considerable size and was never triggered when it was a toy.⁷ But the reasoning that informed these precedents — the cognitive tasks that the judges performed *in the precedent cases* — will not normally be represented. The difference between precedent-based and statute-based reasoning gets lost, and what makes certain forms of reasoning genuinely and uniquely *legal* is eclipsed in favour of a more abstract approach to human intelligence and problem solving.

Recently, however, there has been renewed interest from AI and law researchers in a computational approach to statutory interpretation that renders the reasoning process explicit — and maintains at the same time its distinctiveness as a cognitive-legal meta task.⁸ This paper contributes to this research strand but differs in two crucial regards. First, it aims at a much more fine-grained analysis of legal reasoning than the approaches by Araszkievicz or Sartor and collaborators. The units of analysis, for them, are argumentation schemes and the ways these are played out in reasoning tasks. By contrast, the analysis here will focus on the internal logical structure of rules of interpretation and their interaction with primary norms; our interest is less in what types of argument are used, and more in what cognitive tasks the judges had to perform to enable them to give reasons for their decision. Consequently, whilst they take as their input legal theories and doctrines about statutory interpretation, the starting point here is a specific legal case and the

⁷ Based, of course, on H.L.A. Hart's example; and discussed in Costantini and Lanzarone "Explanation-based interpretation of open-textured concepts in logical models of legislation" *Artificial Intelligence and Law*, no. 3 (1995): 191-208.

⁸ See e.g. Araszkievicz, M. "Towards Systematic Research on Statutory Interpretation in AI and Law" in *Proceedings of the 2013 JURIX conference*, IOS Press, Amsterdam, pp. 15-24, 2013; Sartor, Walton, Macagno, and Rotolo "Argumentation Schemes for Statutory Interpretation: A Logical Analysis" in *Proceedings of the 2014 JURIX conference*, IOS Press, Amsterdam, pp. 11-20, 2014.

reasoning that the judges carry out to resolve it. In this sense, the hope is to complement the abstract, top-down and deductive approach of these authors with an inductive, bottom-up case study approach.

Secondly, the case that is analyzed here is of a somewhat unusual nature. At stake is the interpretation of an international norm which is expressed authoritatively in English and French. This may seem unduly ambitious: if it is already difficult to develop a formal account of statutory interpretation within a legal system, surely, the much rarer and less well understood interpretation of a bilingual legal instrument by domestic courts may seem a step too far.⁹ However, there are pedagogical and methodological advantages in taking multi-lingual decisions as a starting point for analysis. First, using bilingual texts forces us to observe the difference between the outward syntactical structure of a legal statute and its underlying semantics or meaning. For models of legal interpretation, this is a crucial distinction. We need to be able to express ideas such as that “Knives are offensive weapons” and “Messer sind Waffen” have the same meaning. Preserving the linguistic role of the quotation mark thus becomes crucial. Developers of legal AIs that work only in a mono-lingual context tend to blur this distinction — and thus lose one important way in which statutory interpretation as reasoning about meaning works. Secondly, using a case in which the judges interpret (also) a foreign language text forces them to be much more explicit and reflective about what they are doing – again, working in only one linguistic medium can lead highly trained professionals to ‘take much for granted’ and to gloss over theoretical interesting, but practically irrelevant, distinctions. Using the highly unusual scenario (for domestic court judges) of having to reason about foreign language texts thus gets close to

⁹ International courts deal with this problem of course all the time, and have developed their own rules of interpretation for them. Here however, it is crucial that the task is given to a purely domestic forum.

what Garfinkel termed a “breaching experiment”, where normal conventions are violated, and we are forced to reflect more explicitly about the 'seen but unnoticed' background features of everyday life in its taken-for-grantedness.¹⁰ In this way, we can glimpse important insights into the cognitive processes that lead to legal decisions but are normally hidden behind standard templates and expressions of court decisions.

Bilingual legal texts also raise issues of legal interpretation that are interesting in their own right. In their seminal 1977 paper on legal interpretation in the European Communities, Sacks and Harlow argue that:

“It must be permissible for a judge, faced with ambiguity, in a multi-lingual text, to refer to other versions. To hold otherwise would deny equality to the different languages of the Community, and increase the likelihood of conflicting decision in the national courts. [FN 25... "Thirty or more conflicting decisions [on] various articles of this convention already exist).”]¹¹

Maintaining coherence thus is one of the core cognitive tasks that judges have to perform in this context. Yet, for a theory of legal interpretation, multi-language and multi-jurisdiction contexts provide a degree of paradox. On the one hand, as Sacks and Harlow argue, by permitting reference to foreign language sources the number of possible constraints of an interpretation is increased — which should result in a greater degree of

¹⁰ Garfinkel, H. "Studies of the routine grounds of everyday activities" *Social Problems* 11, No. 3 (1964): 225-250. For an application to legal research see Dingwall, Travers, Manzo, Conley, and O'Barr "Language, law, and power: Ethnomethodology, conversation analysis, and the politics of law and society studies" (2000): 885-911.

¹¹ Sacks and Harlow "Interpretation, European-Style" *Modern Law Review* 40, No. 5 (1977): 578-582, 578.

coherence overall; whilst the English version of a treaty may allow two interpretations, the French version may prohibit one of them — thus reducing the number of possible interpretations that account for all of the data. However, this formalistic approach does not match the experience from legal practice. There the impression is more that, by increasing the number of possible valid legal sources, incoherence increases with the number of possible legal precedents that can support an opinion. Instead of ruling out one interpretation a possible outcome could be split courts — with some judges choosing exclusively the English version, the others the French version — and in doing so creating an inconsistent body of precedents that then further complicates interpretation.

This presents us with the challenge of given a formal account of reasoning in multi-jurisdiction systems that captures both aspects of foreign language sources: stabilising and coherence-increasing; destabilising and change-enabling. This paper will discuss several different ways in which such a model can be achieved.

2. *Buchanan v Babco*

I will use, in this paper, one specific case: *James Buchanan & Co. Ltd. v. Babco Forwarding & Shipping (UK) Ltd.*¹²

The facts of the case are as follows: Babco Forwarding & Shipping ("Babco") entered into a contract with James Buchanan & Co ("JBC") for the carriage of 1,000 cases of whisky from Glasgow to Iran. Babco collected the whisky from a bonded warehouse in Glasgow, loaded it on to a trailer, and sent it on its way to Felixstowe for shipment. On its

¹² [1978] A.C. 141.

way from Glasgow to that port the trailer was taken to a lorry park in North Woolwich. There it was left for the week-end. When the lorry driver came to collect the whisky-laden trailer after the weekend he found it had been stolen.

Whisky intended for export is exempt from UK excise duty and, therefore, no such duty had been paid on it. However, as it had been stolen, JBC became liable to pay excise duty (in the amount of £30,000) on it — the presumption now being that the thieves would sell it in the UK (and it would be consumed there).¹³ The contract of carriage incorporated the terms and conditions stated in the "Convention on the Contract for the International Carriage of Goods by Road" — the English and French versions of which were equally authoritative.¹⁴ Now, a potential ambiguity in the Convention arises when the value of the goods is calculated. The English version of Article 23 of the Convention, so far as material, reads as follows:

"1. When, under the provisions of this Convention, a carrier is liable for compensation in respect of total or partial loss of goods, such compensation shall be calculated by reference to the value of the goods at the place and time at which they were accepted for carriage.

2. The value of the goods shall be fixed according to the commodity exchange price or, if there is no such price, according to the current market price or, if there is no

¹³ The relevant legislation is section 85 of the Customs and Excise Act 1952.

¹⁴ However, the Convention had been incorporated into domestic law by the Carriage of Goods by Road Act 1965 — which gave legal force to the English language version only (in the Schedule to the Act).

commodity exchange price or current market price, by reference to the normal value of goods of the same kind and quality ...

4. In addition, the carriage charges, customs duties and other charges incurred in respect of the carriage of the goods shall be refunded in full in case of total loss and in proportion to the loss sustained in case of partial loss, but no further damages shall be payable ..."

The legal issue that arose is: what was the value of the whisky "at the place and time" it was "accepted for carriage" i.e. the warehouse in Glasgow? It was agreed that there was no "commodity exchange price". Was there a "current market price" (or "normal value")? If so, was it £37,000, (including the excise duty) or £7,000 (excluding it)?

This brings us to the bilingual nature of the operative law. Initially, Master Jacob, who assessed the damages, formed the opinion that the value of the whisky when it was taken out of the warehouse included the hypothetical excise duty that could have been levied on it (i.e. £37,000). Any other construction would mean, he said, that there were two artificial values existing side by side, one with and one without excise duty. This is in itself an interesting (onto)logical argument that will have to be taken into account later.

Lord Denning M.R., when the case reached the Court of Appeal, found that the phrase "the value of the goods at the place and time at which they were accepted for carriage" in Article 23(1) was ambiguous — and he resolved that ambiguity (in favour of the amount excluding excise duty i.e. £7,000) by considering the consequences of the

alternative constructions.¹⁵ However, whilst Article 23(4) — “strictly” (i.e. linguistically) interpreted — did not include the excise duty, Lord Denning held that it left a gap to be filled; and, in his opinion, the court ought to adopt the “European Method” of interpretation to fill this gap and obviate a “most unjust” result.¹⁶ He cited Judge Kutscher’s article “Methods of interpretation as seen by a judge at the Court of Justice, Luxembourg” to show how the principles of construction differ from those applied in the UK — and why a continental approach is preferable.¹⁷ Roskill and Lawton L.J.J. concurred in the result but differed somewhat in their reasoning: they held that Article 23(4) was ambiguous; and that looking at the French version was a legitimate way of resolving this ambiguity.¹⁸ In the subsequent appeal to the House of Lords, Counsel for Babco argued that:

“If there be an ambiguity, even in a case such as this where the English and French texts are equally authoritative, the court can take advantage of the French text. There is no such ambiguity here, and therefore no need to have regard to the French text. We have no expert evidence in this case. Schoolboy French is all very well, but one is here dealing with very subtle shades of meaning. ...”¹⁹

We now face at least three possibilities:

¹⁵ *James Buchanan & Co. Ltd. v. Babco Forwarding & Shipping (UK) Ltd.* [1977] Q.B. 208, 212-3.

¹⁶ *Ibid.*, 213-4.

¹⁷ *Ibid.*, 213; Kutscher, H. “Methods of Interpretation as Seen by a Judge at the Court of Justice” in *Judicial and Academic Conference 27-28 September 1976*, p. 1, 1976.

¹⁸ *Ibid.*, 220 (Roskill L.J.) and 222-3 (Lawton L.J.).

¹⁹ *James Buchanan & Co. Ltd. v. Babco Forwarding & Shipping (UK) Ltd.* [1978] A.C. 141, 145.

1. That there is a gap in the Convention which can be filled by judicial decision following a "continental method" of interpretation applied to the French version (Lord Denning M.R.) As a subcategory, this may involve also citing cases from foreign jurisdictions decided under that law.
2. That the relevant English words can be expanded in scope by looking at the French text of the Convention, but interpreting them using common law (UK) methodology (Roskill L.J. and Lawton L.J.).
3. That the relevant words — in English — are, in the context of an international convention, wide enough to include the excise duty (Master Jacob)

Both the Court of Appeal decision and the House of Lords decision offer interesting arguments on two different levels. First, the discussion whether (and, if so, how) the French text of the convention can be used to construe the English text. Second, we find examples of the judges on an object-level actually creating bilingual legal arguments.²⁰ In the speech by Lord Salmon, we find (for instance) the statement:

“For my part, however, I consider that the French version “frais encourus à l’occasion du transport” is no more or less precise than the English version and therefore affords no real help in solving the question which confronts us.”²¹

²⁰ By “object-level” I mean that the bilingual sentences are used to make directly doctrinal points; they are not just part of a general ‘meta-level’ discussion about the method of interpretation.

²¹ *Ibid.*, 161.

Lawton L.J. argued that the word "compensation" used in Article 23(1) had no exact meaning in English Law.²² He considered that what he described as its "latent ambiguity" was at once resolved by the French text, which made it plain

*"... that the intention of article 23 is to provide an indemnity subject to limits,"*²³

and he added:

*"Since the object of article 23 is to give an indemnity subject to limits, the principal limits being a financial ceiling and the exclusion of consequential damage, it seems to me that paragraph 4 of article 23 should be construed broadly."*²⁴

He then examined the French text of Article 23(4), and concluded that:

"The French phrase "encourus à l'occasion" conveys the concept of 'arising from,' 'occasioned by' or 'resulting from.' The French text has convinced me that the words in the English version of paragraph 4 of article 23 should be construed as meaning 'any other expenses which the owner of the goods has to pay as a result of the

²² *James Buchanan & Co. Ltd. v. Babco Forwarding & Shipping (UK) Ltd.* [1977] Q.B. 208, 223.

²³ *Ibid.*

²⁴ *Ibid.*

*carriage of the goods.' The payment by the plaintiffs of excise duty was just such an expense."*²⁵

In the arguments of those judges who think use of the foreign text is legitimate we find two interesting features. The first is matter of linguistics. The way in which the judges introduce French law, syntactically, is through quotation marks; these can form terms, which then, in turn, can be subject of predication. This enables us to ‘talk about’ language using language — in a reflexive mode. In this process, the semantic role of the quoted words can change. As an illustration, the word “snow” plays a different semantic role, contributes to the truth of the sentence in which it occurs, in very different ways in:

- a) Snow is white;
- b) “Snow is white” and “Schnee ist Weiss” have the same meaning; and
- c) “Snow is white” is a well-formed sentence that has exactly three words.

A complete formal account of the reasoning in our case needs to be able to track these different roles a term can play —and to preserve the difference in meaning that quotation marks introduce.

The other feature is procedural-legal, an issue of bringing in relevant knowledge — even though their French is obviously of varying quality and limited to what they learned in school — it is utilised to overcome an apparent inconsistency and restore a uniform, consistent reading. How, if at all, can these strategies be formally represented so that

²⁵ *Ibid.*, 224.

eventually, a computer might perform them (and perform them potentially better, with better access to information about French)? In what follows, a partial answer to this question is suggested, by briefly introducing two competing formalisms and linking them to influential theories about legal reasoning. In this way, the hope is that we can learn more about the structure, range, and plausibility of these theories

3. Paraconsistency in multi-language statutory interpretation

As we have seen, the immediate problem that was posed in this case was to resolve apparent inconsistencies between different interpretations. Inconsistency arose on the one hand between different interpretations of the English version of the statute, and between the French and the English version.

Seen from the perspective of legal theory, Master Jacob is the most traditional of the judges involved in this case. The vision of a legal system that models his reasoning is, in an important respect, essentially Dworkinian – the path-dependency of English law must not be derailed by external influences, the chain novel can and should be continued using UK law alone. His system is both normatively and cognitively closed;²⁶ no exchange takes place, but consistency is maintained. Denning M.R. and Roskill L.J., by contrast, are cognitively open to the influence of foreign law. However, Roskill L.J.'s approach stays normatively closed – the potential “irritant” of the foreign language version of the law is to be interpreted using common law methodology only and thus made compatible with the

²⁶ In the terminology of system theory, see e.g. Luhmann, Niklas "Operational closure and structural coupling: the differentiation of the legal system." *Cardozo L. Rev.* 13 (1991): 1419.

receiving body of law.²⁷ That the import may change in the process substantially from its originally intended meaning is not just inevitable, it is desirable. Denning M.R.'s approach, by contrast, remains normatively open. One should also note that this process is self-reflective in a crucial way. It is not simply the case that, in *Buchanan v Babco*, a small piece of French substantive law was purportedly introduced into UK jurisprudence. Rather, by giving reasons for his decision and deliberating explicitly on the method of interpretation that should be used, Denning M.R. also tries to change the criteria of what counts as a valid legal argument in UK law. Meta-level reasoning and subject level reasoning are crucially intertwined, and it is this connection that shows why it is not hyperbole to say that in cases such like this, the very nature of a legal system, its self-understanding, may be changed through an 'irritant'.

Developing a formal account of this type of inconsistency and its resolution is, for many reasons, a considerable challenge. Classical logic is unforgiving towards inconsistencies. The reason for this is known as the principle of explosion – from an inconsistent set of premises, every conclusion can be reached.²⁸ This is the ultimate justification behind Master Jacobs' argument that it is simply not acceptable to have two contradictory values of the same product at the same time.

However, in this approach inconsistencies are prohibited from the outset as a methodological fiat, not analysed — and this does not account for what happened in our

²⁷ Following the terminology of Teubner, who treats foreign imports into legal systems as "irritants" – as opposed to Alan Watson's "transplants" that force the receiving legal system to neutralize them. Teubner, G. (1998) "Legal irritants: good faith in British law or how unifying law ends up in new divergencies", *The Modern Law Review*, 61(1), 11-32.

²⁸ Carnielli and Marcos "Ex contradictione non sequitur quodlibet" in *Proceedings of the Advanced Reasoning Forum Conference*, vol. 1, pp. 89-109, 2001.

case. Here, the judges reason about the inconsistencies they find; which requires us to find a way to reason with (and about) them that does not lead to the logical explosion of classical logic. Paraconsistency, a term coined by Miró Quesada,²⁹ enables a more permissive approach to inconsistencies. There are by now quite a number of competing formalisms that try to represent the intuition that, sometimes, we hold inconsistent beliefs without necessarily, as a result, believing everything.³⁰ We can give here only a first impression of the field and focus on some aspects that are, from a jurisprudential and computational perspective, particularly interesting. The first formal account of a system that blocks logical explosion was developed by the Polish logician Stanisław Jaśkowski in 1948.³¹ His main focus was on the logic of discourse: in a debate, a participant proposes positions or beliefs that (if sincere) are true according to the participant. The beliefs will be self-consistent, as a bare minimum, yet will often be inconsistent with those of the opponent. To model the discourse from the sum of its constituent parts, Jaśkowski formalised this in the form of a discursive logic, with a ‘possible worlds’ semantics. If someone asserts a sentence A in a discourse, they are (from their internal perspective) expressing an unequivocal commitment to the truth of A , e.g. ‘The normal value of the whisky is £37,000’. From the perspective of the discourse, however, this is interpreted as the much weaker “it is possible that A ” ($\Diamond A$). As external observers of the court’s deliberations we take the message that, depending on the chosen approach to statutory interpretation, the value of the whisky is possibly £37,000 — but also possibly only £7,000. This allows for the translation of

²⁹ Quesada, M. F., “Heterodox logic and the problem of the unity of logic”, *Journal of Symbolic Logic* 43 (1976): 354.

³⁰ For an overview, see e.g. Brown, B. “On Paraconsistency”, in Dale Jacquette (ed.) *A Companion to Philosophical Logic*, (Oxford: 2002), 628-650 or Priest, G. “Paraconsistent Logic”, in Gabbay and Guenther (eds.), *Handbook of Philosophical Logic* Vol. 6, (Dordrecht: 2002) 287-393.

³¹ Perzanowski, J. “Fifty years of parainconsistent logics” *Logic and Logical Philosophy* 7 (2004): 21-24.

sentences of the new discursive logic into the language of modal logic (typically *S5*). *A* then holds true in a discourse iff *A* is true in *some* possible world of the set of all possible worlds *M* over which *S5* is interpreted. And, since *A* may hold true in one world but be false in another, both *A* and $\neg A$ (not-*A*) may hold true in one and the same discourse.

There is something intuitively appealing about this approach in legal contexts. Legal adjudication is a dialogical process. Not only that — when it comes to high level, precedent-setting adjudication in appeal cases, it is almost inevitably the case that both sides will be able to make good arguments for their respective positions; if one position were obviously untenable, the case would have been terminated long ago. If, then, the very best judges disagree amongst themselves in their respective speeches too, it seems inevitable to conclude that the various interpretations are (at the very least) all possible; though eventually one may turn out to be more plausible than the others. So whilst, “from the inside”, every party’s monologue argues that its interpretation *A* is *true*; from the outside, the perspective of the dialogue, what they’ve really argued is just that their interpretation is *possible* – and they may even realise that this holds true for the other side as well (though they may not admit to that explicitly). It is precisely this transition from the inside perspective of the discussants to the outside perspective of the dialogue, or legal system, that Jaśkowski’s logic is based on.

The idea that “worldviews” or belief systems will typically be internally coherent, but mutually inconsistent — so that every formal representation that models talking about several such systems needs to be able to handle inconsistencies — has been developed, for instance, by Batens (1998).³² However, his research also shows the limitations of a

³² Batens, D. "Dynamic semantics applied to inconsistency-adaptive logics." *Logical Investigations* 5 (1998): 74-85.

paraconsistent analysis; both formally and from a philosophical perspective. Whilst it allows us, on the object-level of the formal language, to tolerate inconsistencies and to represent them, they disappear, on the meta-level, and become indices to possible worlds. So whilst we can formally represent the statements ‘Babco owes £37,000 and not £7,000’ and ‘Babco owes £7,000 and not £37,000’ — in the language of discourse logic — their meaning — seen from a meta-language perspective — simply becomes ‘there is a world (a legal system) in which Babco owes £37,000 and a different world (legal system) where it owes only £7,000’. But, of course, we could have achieved the same in the object language and stayed within the formal framework of classical logic — by talking explicitly about jurisdictions or interpretations. The statements: ‘Interpreted within the French legal system, Babco owes £37,000 and not £7,000’ and ‘Interpreted within the common law system, Babco owes £7,000 and not £37,000’ are, of course, consistent with each other. So, whilst paraconsistent logics allow us to give a formal computational account of the issue under debate, it tells us much less about how the conflict is to be resolved.

4. Ontology repair and context semantics³³

The approach sketched out above emphasises the importance of logic, argumentation and reasoning in statutory interpretation and legal decision-making. A somewhat different approach is to focus less on the linguistic features and more on the type of objects that a theory or argument are ‘about’ – the ontology, rather than the logic, of a system. From a computer science perspective, an ontology is “an explicit specification of

³³ The formal approach introduced in this section is a highly condensed account of work Andrew Priggle Higson carried out as part of his MPhil studies at the University of Edinburgh (supervised by the author and Alan Bundy). The connections to the legal issues is developed further here, at the expense of technical detail — for which the reader is referred to Hinson’s thesis: <https://core.ac.uk/download/files/39/279781.pdf>.

a conceptualization”; an ontology is a description (like a formal specification of a program) of the concepts and relationships that can formally exist for an agent or a community of agents.³⁴ This definition is consistent with the usage of ontology as set of concept definitions but is more general:

“Ontologies are often equated with taxonomic hierarchies of classes, class definitions, and the subsumption relation, but ontologies need not be limited to these forms. Ontologies are also not limited to conservative definitions — that is, definitions in the traditional logic sense that only introduce terminology and do not add any knowledge about the world. To specify a conceptualization, one needs to state axioms that *do* constrain the possible interpretations for the defined terms.”³⁵

This abstract and rather technical definition is important for us for two reasons: First, it links explicitly the development of ontologies with that of interpretation — the topic of this paper and indeed the special issue. Secondly, it reminds us that, even though the type of sentences that we encounter look like mere definitions, these play a different role from definitions as traditionally understood in logic. When the law – or the ontology engineer – proposes a definition, a more substantive statement about the world is intended than a mere clarification of language use. For lawyers, especially continental lawyers, the ‘ontology’ of a law is what is described in the general part of a Code – the part where the domain of the law is specified and the domain of regulation is explicated. So we could translate the

³⁴ Gruber, T. R. "Toward principles for the design of ontologies used for knowledge sharing?" *International Journal of Human-Computer Studies* 43, no. 5 (1995): 907-928, 908.

³⁵ *Ibid.*, footnote 1.

role of the general part of a Code as stating that ‘private law is about persons, things and objects (top-level categories), the first is divided into natural and juridical persons (specification of the top-level concepts)...’ But, as Gruber notes, for the information-science understanding of ‘ontology’ these need not be understood as “conservative” or mere definitions in the logical sense. Rather, their meaning can change over time — as the axioms that constrain possible interpretations change. One way in which this can happen in law, as we have seen, is in the case of cross-jurisdiction (or cross-language) transfer of legal concepts. Introducing the French text added new axioms that constrained the range of possible (permitted) interpretations of the English legal concepts. The French text acted as an ‘irritant’ in the recipient system, which then has to transform both itself and the irritant to reach a new stable state:

“But, before concluding this judgment, I would like to support what Lord Denning M.R. has said and what Lord Justice Lawton will say regarding the need to alter the traditional English method of approach to questions of construction of statutes such as the 1965 Act which give effect on a matter of municipal law to international conventions. Some such conventions are drafted in languages other than English. [...]. Now that this country has joined the European Community our courts are likely to be increasingly concerned with the interpretation of legislation of one kind or another of which English is not the original or the dominant language. Such legislation is likely also to fall for interpretation in the courts of other members of the Community. It would be disastrous if our courts were to adopt constructions of such legislation different from those of other courts whose method of approach is

different and far less narrow than ours merely because of over-rigid adherence to traditional — some might call them chauvinist — English methods. [...] I think in the future our courts should be far more ready, in cases where international conventions, especially those affecting the members of the European Community, are under judicial consideration, to assimilate their approach to questions of the construction of our legislation giving effect to those conventions to that which the courts of other members of the Community are likely to adopt.”³⁶

Crucially, what we encounter here is not necessarily a fixed set of rules of interpretation; rather, the rules themselves may change in the process of their application when the system encounters a problem in the form of an inconsistency.

Similar processes are tackled by system engineers in artificial intelligence research. A computer system may receive an input that is inconsistent with its knowledge base. Rather than having a logical explosion, the system tries to repair itself — making the necessary modifications autonomously. For this, it needs to reason also about the very process of repairing itself; making notions such as ‘context’ explicit. Ontology matching and ontology repair has been an active research field in computer science and AI research for the last decade; with several important insights on the way in which agents from different (social, cultural, historical) backgrounds manage to realign their respective worldviews and, in this way, evolve their theories about the physical world.³⁷ If we apply

³⁶ *James Buchanan & Co. Ltd. v. Babco Forwarding & Shipping (UK) Ltd.* [1977] Q.B. 208, 220-221.

³⁷ See e.g. Bundy and Chan "Towards ontology evolution in physics" in *Logic, Language, Information and Computation*, pp. 98-110, Springer Berlin Heidelberg, 2008; Chan and Bundy (2008) "Inconstancy: An Ontology Repair Plan for Adding Hidden Variables", in *AAAI Fall Symposium: Automated Scientific Discovery* (pp. 10-17).

the resulting formalisms to the evolution of a legal doctrine, we can begin to understand the similarities and dissimilarities between interpretation of scientific laws by human researchers and interpretation of statutory laws by judges, lawyers and others.

To transfer the ideas from computational ‘ontology matching and repair’ to our legal example would require a formal ontology representation of the two putative objects, the French and the English “value of the goods” (one with excise duty as a necessary part, the other without), valid in their respective contexts, and then formalise the meta-reasoning that compares, matches and ultimately combines (repairs) the two.

I will now sketch very briefly and cursorily how one specific approach within the field of ontology repair, ‘context logic’, can capture the type of reasoning that we found in *Buchanan v Babco*.³⁸ The term ‘Multi-Context Logics’ (MC Logics) refers to a family of logics for the representation of contextual reasoning based on the two following principles:

- * Principle of Locality: Reasoning uses only part of what is potentially available

An English lawyer will not normally use French precedents to argue a case, even though they know that there is such a thing as ‘the French legal system’ and that they can, if needed, draw on this resource. The part that is used in reasoning is called the ‘context’ (of an argument). Note that, whilst similar to a possible world, the notion of context is much more fluid and task-specific.

³⁸ See Serafini and Giunchiglia, "MI systems: A proof theory for contexts" *Journal of Logic, Language and Information* 11, No. 4 (2002): 471-518.

* Principle of Compatibility: There is compatibility among the reasoning performed in different contexts.

This principle we mention only to then (partly) violate it. One of the potential problems of the paraconsistent approach (outlined above) is that it preserves the inconsistencies but prevents conflict between them. In multi-context logics we have instead a fundamental assumption that repair is possible: that, at least temporarily, consistency and stability can be achieved. To do this, these logics view ‘context’ as a set of interacting formal theories; each with its own language, semantics and axiomatic system. Relations between contexts are represented as interaction between theories. The fact that these theories each have their own language makes them particularly suitable for issues such as that in *Buchanan v Babco* – something traditional logic, which takes place in the ‘heaven of propositions’ independent of any specific natural language, can’t replicate.

As we discussed above, in a classical logical approach to modelling the logician would rely on the legal expert to give ‘the’ logical structure of the relevant piece of international law — thus preempting (to a degree) the legal debate on which version to use; this has to precede any attempt to model the reasoning by the court. By contrast, multi-context logics can talk about ‘the Convention in its French law context’ and ‘the Convention in its English law context’; where a ‘bridge rule’ between the contexts ensures that we speak about the same Convention — but a Convention with different logical form in each context.

The notion of context as an individual’s (partial and approximate) theory of the world plays an essential role here. The crucial shift from modal logic to contextual logic is

that the first encodes an ‘objective’ perspective on problems – based upon the concept of a possible world – whereas the second encodes a ‘subjective’ perspective – based upon the concept of a context. One of the first logicians to explore this notion, John McCarthy, advocated the use of context to cope with exceptions to general rules.³⁹ The basis of McCarthy’s contextual logic is a “*ist(c; p)*” predicate, which asserts that proposition *p* is *true in context c*; and linking axioms, which assert a relationship between *ist* predicates for different contexts. McCarthy further developed the idea by introducing an “outer context”: all propositions are asserted with respect to a context; with the outer context as the containing context for all contexts.

The Giunchiglia (or “Trento”) model of context is based upon the idea of a multi-context (MC) system.⁴⁰ These systems are based upon similar intuitions to the McCarthy model of context but, rather than introducing an “*ist*” predicate, they use context as part of the meta-logic and introduce “bridge rules” to enable inter-context reasoning. This difference also means that contexts and bridge rules are not object-language objects in a MC system; so we can’t reason about them explicitly – which was one of the desiderata when the paper discussed the way in which the judges use quotation marks in their reasoning. This is the reason why, below, we will combine this approach with McCarthy’s. A context consists of a logical language (e.g. first-order logic), a set of axioms in this language (e.g. the rules of English law) and a set of inference rules. The notation $c : F$ is used to express that ‘formula *F* is true in context *c*’. Reasoning between contexts is done using bridge rules — rules whose premises and conclusion belong to different contexts.

³⁹ McCarthy, J. “Notes on formalizing context”, *Proceedings of the Thirteenth International Joint Conference on Artificial Intelligence*, 1(1993) 555–560.

⁴⁰ REF.

In what follows, the paper will use the Trento notation $c : p$ to indicate that proposition p is true in context c . However, we use the McCarthy approach to contexts; so that contexts can be treated as first-class objects within the logic. This is crucial to making explicit the reasoning of the judges. The notation $c : p$ should be considered shorthand for the assertion $ist(c; p)$.

A ‘legal-system context’, then, defines the rules that govern the reasoning and procedures within a given legal system. These rules place constraints upon how lawyers can behave in a case within that legal system. For example, there might be the following rule in the English Legal System:

English law : For all $X;Y$: $similar(X;Y)$ & there is a $V;V'$: $verdict(X;V)$ & $verdict(Y;V') \rightarrow V = V'$

which expresses that, in the context of English law, if two cases are similar then their verdicts should be the same.

This rule (partially) expresses the principle of binding precedent in English law, and can have (for a formal analysis) a two-fold purpose: it is an element of the context within which the decision takes place; and, at the same time, can form part of the argument that the parties are making – ‘we are in the context of English law, and hence interpretation X should hold’ vs ‘we are in the context of English law, but should change this context so that Y holds’. Self-reflexivity is one of the characteristics that enable a system to repair itself and to grow through importing new elements — which can also be ‘context changing’.

We now have assembled the building blocks for a formal representation of key aspects of our case. First, we introduce the various *contexts* that appear in their Lordship's reasoning:

- *english* denotes the English legal system;
- *french* denotes the French legal system;
- *bvs* denotes the context in which the the Dutch case that the House of Lords evokes, *British-American Tobacco Co. (Nederland) B.V. v. van Swieten B.V.*, was decided;
- *act* denotes the Act of Parliament enacting the Convention;
- *convention* denotes the international Convention; and
- *rwe* denotes the real-world event that led to the case — ‘what really happened’ independently of any legal framing of the issue.

The *contexts* represent the social, interpretative and situational contexts in the case. The *english* and *french* contexts represent legal systems, which could be thought of as social contexts representing a conceptualisation of the social institution of law. The *act* and *convention* contexts are interpretative contexts representing the interpretation of legal documents. The *bvs* and *rwe* contexts represent situations which have occurred and whose details are relevant to the case – having these formally represented allows us to reason about the difference between points of law and points of fact. There are logical relations between these contexts that we could now express as additional axioms. The *legal system contexts* contain the *legislation* contexts, for instance the *act* legislation context is within

the *english* legal system context. (Or, in other words, the Act that transposes the Convention into English law is part of the English legal system — the operative context.)

Secondly, we have a list of *predicates*, or properties, that hold within these contexts:

- *openTexture*(X) means the phrase X is open-textured;
- *treaty*(X, Y, C) means that the phrase X has a corresponding phrasing as Y in an authoritative version of the international treaty C – so this predicate links French and English translations of the same international instrument;
- *includes*(X, Y) means that noun phrase X includes the concept Y ;
- *purposive*(C, X) means that the interpretation of legislation in context C as including the proposition X is a purposive interpretation of the legislation (‘interpreted the continental way’, as Lord Denning would have it); and
- *expert*(P) means that proposition P is claimed as a matter of expertise.

This last predicate is, for our case, slightly misleading. The judges talk about their respective expertise and its limits. There was talk about e.g. their “Schoolboy French” or making “reference to a good dictionary”.⁴¹ In variations of the case they might have decided to use an expert to testify as to the meaning of the French text of the Convention. Having a predicate like this allows us to represent the varying degrees of confidence that we can find expressed or made explicit in statutory interpretation. Finally, we have a number of *functions*:

⁴¹ *James Buchanan & Co. Ltd. v. Babco Forwarding & Shipping (UK) Ltd.* [1978] A.C. 141, 145 (per Counsel for Babco); 152 (per Lord Wilberforce).

- “*othercharges*” denotes the phrase “other charges incurred in respect of carriage” in the Convention;
- *excise* denotes the concept of excise duty; and
- “*encourus*” denotes the French phrasing of “other charges ...” in the Convention.

Here we can see how our approach allows us to preserve the fact that, even though they may have identical meaning, there are two natural language versions of the Convention: one in French and one in English. In classical logic, this could not be expressed; as terms with identical meaning get assigned identical formal representations.

We can now try to formalise the interpretative argument for the proposition that it is acceptable to consult the French version of the convention.

1. $act : openTexture("othercharges")$
2. $convention : includes("encourus", excise)$
3. $treaty("othercharges", "encourus", convention)$
4. $act : openTextured(X) \wedge treaty(X, Y, C). \rightarrow (convention : includes(Y, A) \rightarrow act : includes(X, A))$

The axioms state the following:

1. that, in the context of the Act of Parliament enacting the Convention, the phrase “other charges ...” is open-textured;

2. that, in the context of the Convention, the phrase “*encourus...*” includes excise duty;
3. that, in the context of the Convention, the phrase “*other charges...*” has a corresponding phrasing as “*encourus...*”; and
4. that, in the context of an Act, if a phrase is open-textured and that phrase has a corresponding phrasing as *Y* in an authoritative version of an associated international treaty then if the interpretation of that corresponding phrase in the treaty includes a concept *A* then the Act should also include concept *A*.

This fourth axiom is designed to express the idea of resolving uncertainties in the interpretation of the domestic law that enacts an international treaty by reference to more determinate interpretations in other language versions of that treaty.

Eventually, we would want to derive from these axioms the following claim:

act : include(“othercharges”,excise)

but this would require a more extensive formalisation of the arguments than is possible here.

We could then try to formalise the argument that we are permitted to use the European methods of interpretation when consulting the English text; for example:

1. $french : purposive(convention, includes("encourus", excise))$
2. $french : purposive(C, P) \rightarrow C : P$
3. $act : openTexture("othercharges")$
4. $french : purposive(convention, includes(X, A)) \wedge act : openTextured(X) \rightarrow act : includes(X, A)$

These axioms could be used to justify the following claim:

$act : include("othercharges", excise)$

which is how the case was eventually decided. The axioms state the following:

1. that, in the context of the French legal system, there is a purposive interpretation of the Convention which would include excise duty within the French phrase “other charges ...”;
2. that, in the context of the French legal system, if P is a purposive interpretation of a legislation context C then P is the interpretation to be adopted; and .
3. that, in the context of the Act of Parliament enacting the Convention, the phrase “other charges ...” is open-textured;

4. that we should use this purposive interpretation to resolve an issue of open texture in the phrasing of an Act.

We could also try to formalise the argument that we can use the European methods when interpreting a foreign case for the purpose of (in the context of) disambiguating domestic law.

5. Conclusion

I've been able to give only a broad outline of how we might produce a formal analysis of *Buchanan v. Babco* that is capable of replication on a computer yet still preserves all those features of the argument that are interesting for a theory of statutory interpretation. There are nonetheless several lessons that can be drawn from our analysis so far. First, using examples from multi-lingual statutory interpretation did, as we had hoped for, bring to the surface many more of the cognitive operations that lawyers have to carry out when interpreting a statute. Secondly, doing justice to the way in which lawyers reason about statutory interpretation forced us to go beyond classical logic, — and to amend our formal vocabulary considerably. This was (also) caused by a self-reflexive process: court decisions like *Buchanan v Babco* involve simultaneously reasoning about primary legislation, using tools of statutory interpretation, *and* about the adequacy of these tools themselves (which may, in the process, change those tools). Thirdly, whilst statutory interpretation is therefore different from other legal reasoning tasks, the underlying structure showed clear similarities to the way in which contested theories in the natural

sciences evolve, adjust and resolve inconsistencies between them. Crucial for this process was the ability to keep conflicting models of the text in the mind simultaneously, for a certain time at least, and then resolving the inconsistency by matching, merging and repairing these models. Syntactic models of legal argumentation alone cannot capture this process adequately; rather, we need to look at the way law ‘creates realities’ — made possible in our approach through a focus on the semantic interpretation of terms within a modal setting. For a theory of legal statutory interpretation, the insights that the formal approach brings are the recognition of the similarity to other, non-legal, reasoning tasks (and with that the ability to bring results of other disciplines to bear for future studies) and also the way in which certain interpretative choices (and commitments to theories of interpretation) interact with each other. For the future, the aim would be to give a more comprehensive account of the reasoning in a number of choice cases — to test the adequacy of the approach suggested here.

In the semi-formal approach of this paper, certain background assumptions remained implicit — making it, at this stage, not possible to fully replicate the reasoning by a software agent. Just how much these assumptions to are amenable to computational representation would give an indication just where, in legal reasoning, an irreducible human element is needed.